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Tariff Reduction and Employment in Canadian Manufacturing, 1988-1994

by Sébastien LaRochelle-Côté

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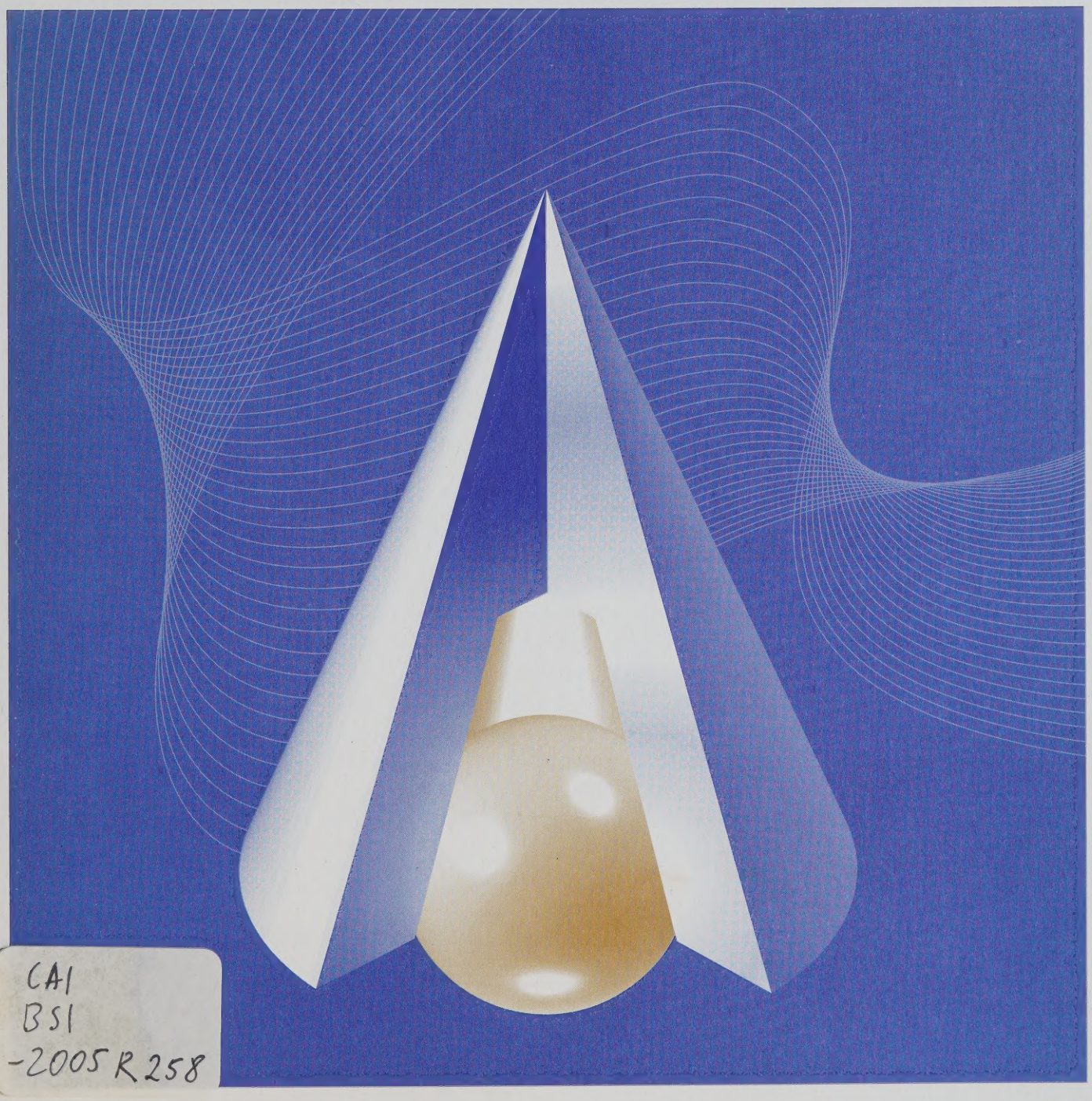

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Note of appreciation
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Abstract

This paper uses firm-level data from the T2/LEAP to investigate whether the link between tariff changes and employment differed across firms with various productivity and leverage characteristics over the period 1988 to 1994. The results suggest that the combined effect of domestic and U.S. tariff reductions on employment was typically small, but that losses were significantly larger for firms which were less productive. For instance, firms with average productivity in 1988 responded to tariff changes by cutting employment by only 3.6% over the period 1988 to 1994, while lower productivity firms typically shed 15.1% of their workforce over the same period. This paper also indicates that firms which were more heavily in debt downsized more in response to declining domestic tariffs, suggesting that financial constrains became more binding when tariff cuts were implemented. These results suggest that firms with high productivity and low leverage were less likely than others to feel the impact of declining U.S. and domestic tariffs.

Keywords: Tariffs, Employment, Manufacturing, Productivity, Leverage.

1. Introduction

At the end of the 1980s, Canada and the United States reached an agreement to phase out import tariffs over a 10-year period beginning January 1st, 1989. This tariff reduction scheme was a major centrepiece of the Canada-U.S. Free Trade Agreement (FTA), a substantial trade policy initiative[1]. The implementation of the free trade deal was followed by a recession characterized by massive job cuts in manufacturing industries. Many have suggested that these employment losses were related, in part, to the reduction of trade barriers. For example, Beaulieu (2000) and Gaston & Trefler (1997) found that fewer jobs were lost in least-protected industries and more jobs were lost in most-protected industries.

Recent empirical studies focusing on firm output and firm survival have shown that the impact of tariff changes was different in more productive firms or firms in better financial health (Gu, Sawchuk and Whewell, 2003; Baggs, Head and Ries, 2002; Baggs, 2004). This raises the possibility that the impact of tariff changes on employment was not only different across industries, but also across firms with different attributes *within* industries.

This paper contributes to this literature by investigating whether tariff changes affected employment differently in firms with different productivity and leverage characteristics at the onset of the implementation of tariff cuts.

It finds that that the impact of falling Canadian tariffs on employment was larger in firms which were less productive *a priori.* It also finds that falling U.S. tariffs were associated with increasing employment in least-productive firms but not in most-productive firms, possibly because more productive firms were already exporting to the United States, while low productive firms were less likely to do so. Furthermore, the results suggest that firms with a larger debt-to-assets ratio downsized more in the face of declining domestic tariffs. These results suggest that firms with high productivity and low leverage were less likely than others to feel the impact of declining U.S. and domestic tariffs.

This study will not look at the possible impact of other provisions of the Canada-U.S. FTA on employment changes, nor will it delve into the possible long-term consequences of a free-trade pact on employment. Rather, the goal of this study is to see if tariff reductions had an impact on manufacturing employment among surviving firms in the immediate aftermath of their implementation and to see if this impact differed across various categories of firms.

This paper is organized as follows. Section 2 includes a description of the tariff reduction scheme adopted by both countries at the end of the 1980s and the ensuing reduction in manufacturing employment. Section 3 discusses the theory and reviews previous empirical studies related to the impact of trade barriers on the labour market. Section 4 focuses on the data and the methodology. Results are shown in section 5.

1. The Canada-U.S. free trade deal was the most important international trade policy initiative implemented by the Canadian government since the Tokyo Round of the GATT negotiations completed in 1979.

2. Motivation

A tariff can be interpreted as an *ad valorem* tax imposed by a government on imports (or exports) from another country (this paper focuses on import tariffs). Before the implementation of the Canada-U.S. free trade agreement, many goods already crossed the Canada-U.S. border free of duty, but many others were still heavily protected by tariffs, which could be as high as 20%. In 1988, the two countries agreed to gradually eliminate their tariffs for all categories of goods over a period of 10 years. Various timetables were set for 93 different categories of goods. Most tariffs took 10 years to be removed, but some were eliminated immediately and others over five years only. Some of the tariff changes were significant, and all tariffs were eliminated on a reciprocated basis. Of note, the Canadian tariffs were much higher than the equivalent U.S. tariffs before free trade was implemented. Thus, absolute changes in U.S. tariffs were much smaller than absolute changes in Canadian tariffs.

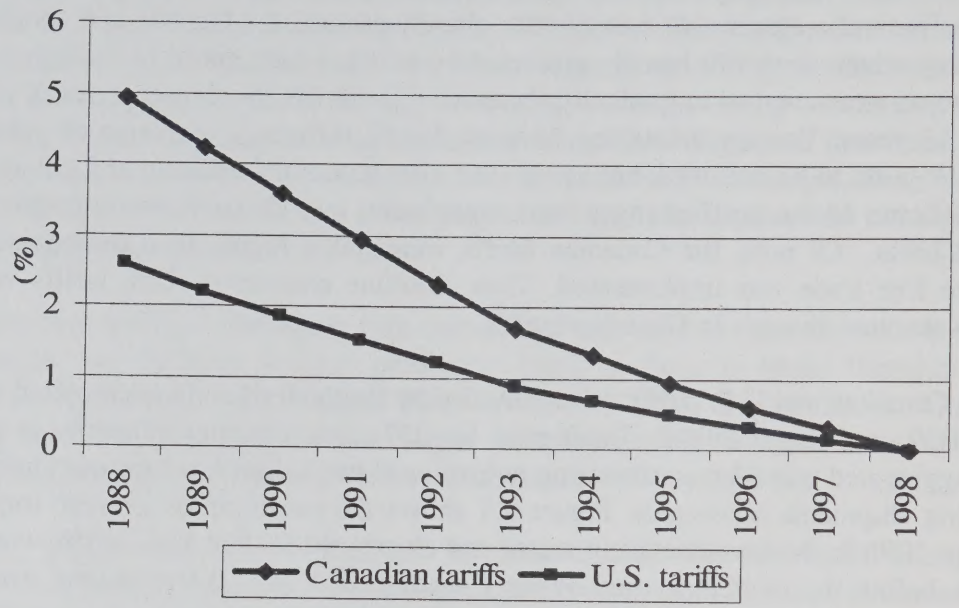
The data on Canadian and U.S. tariffs were provided by Keith Head and are compiled as in Head and Ries (1999) and Baggs (2004). Tariff rates for 237 manufacturing industries at the 4-digit level were aggregated into 83 manufacturing industries at the 3-digit level for our analysis, using manufacturing shipments as weights. Figure 2.1 shows the evolution of average import tariffs from 1988 to 1998 in the manufacturing sector and clearly shows that U.S. tariffs were at much lower levels before the implementation of the Canada-U.S. FTA. It shows that, overall, tariff cuts were much larger on this side of the border. This paper examines the impact of Canadian and U.S. tariffs on a separate basis.[2] In addition, Figure 2.1 also shows that the most significant changes in tariffs took place in the early years of the Canada-U.S. free-trade agreement.

In the immediate aftermath of the implementation of the tariff reduction scheme, employment dropped substantially in Canadian manufacturing industries[3] (Figure 2.2). From 1988 to 1994, total manufacturing employment declined by 10.8%. The decline was even sharper (-17.6%) among firms which already existed before 1988 and survived at least two years beyond the beginning of the agreement, which are the focus of this paper.

2. This paper focuses on tariffs, but the Canada-U.S. free-trade agreement also eliminated some of the non-tariff barriers (NTBs) and included some provisions for investment and services. The two governments extended the principle of national treatment to a limited number of commercial services, and chose not to harmonize the treatment of service providers. The two governments remained free to regulate the services sector, provided that the regulation did not discriminate against providers from one specific party. Canada agreed to phase out certain aspects of the review of the acquisition of firms by U.S. investors and both countries agreed to grant national treatment to new businesses—but the FTA also grandfathered all existing laws, policies and practices except where specific changes were required. Hence, it can be argued that the tariff reduction scheme was the main cornerstone of the FTA. More details can be found in "The Canada-U.S. Free Trade Agreement: A Synopsis" (1987).

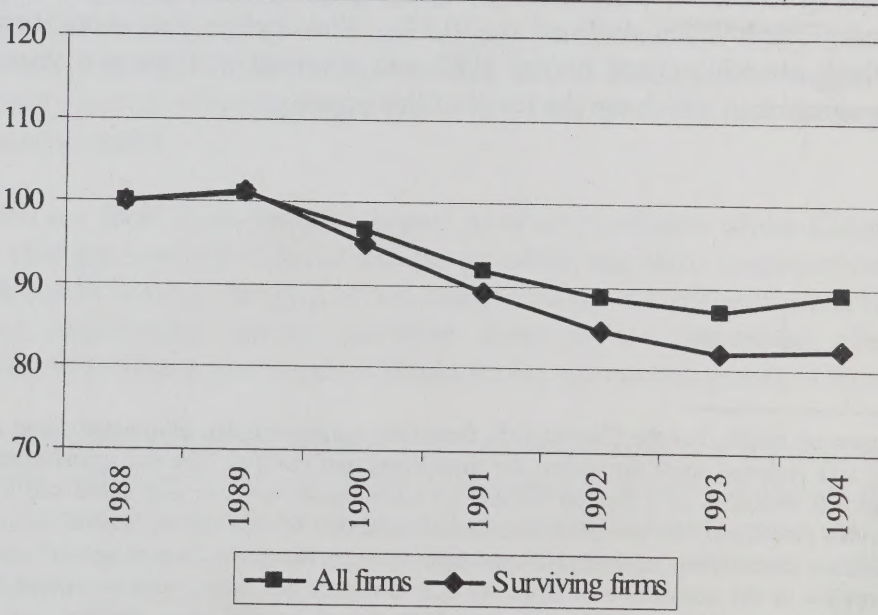
3. According to the Labour Force Survey of Statistics Canada, the proportion of the Canadian workforce employed in manufacturing industries remained relatively constant over the 1980s.

Figure 2.1: Evolution of average tariffs in manufacturing goods (1988-1998), Canada and United States



Source: Head and Ries (1999); Baggs (2004).

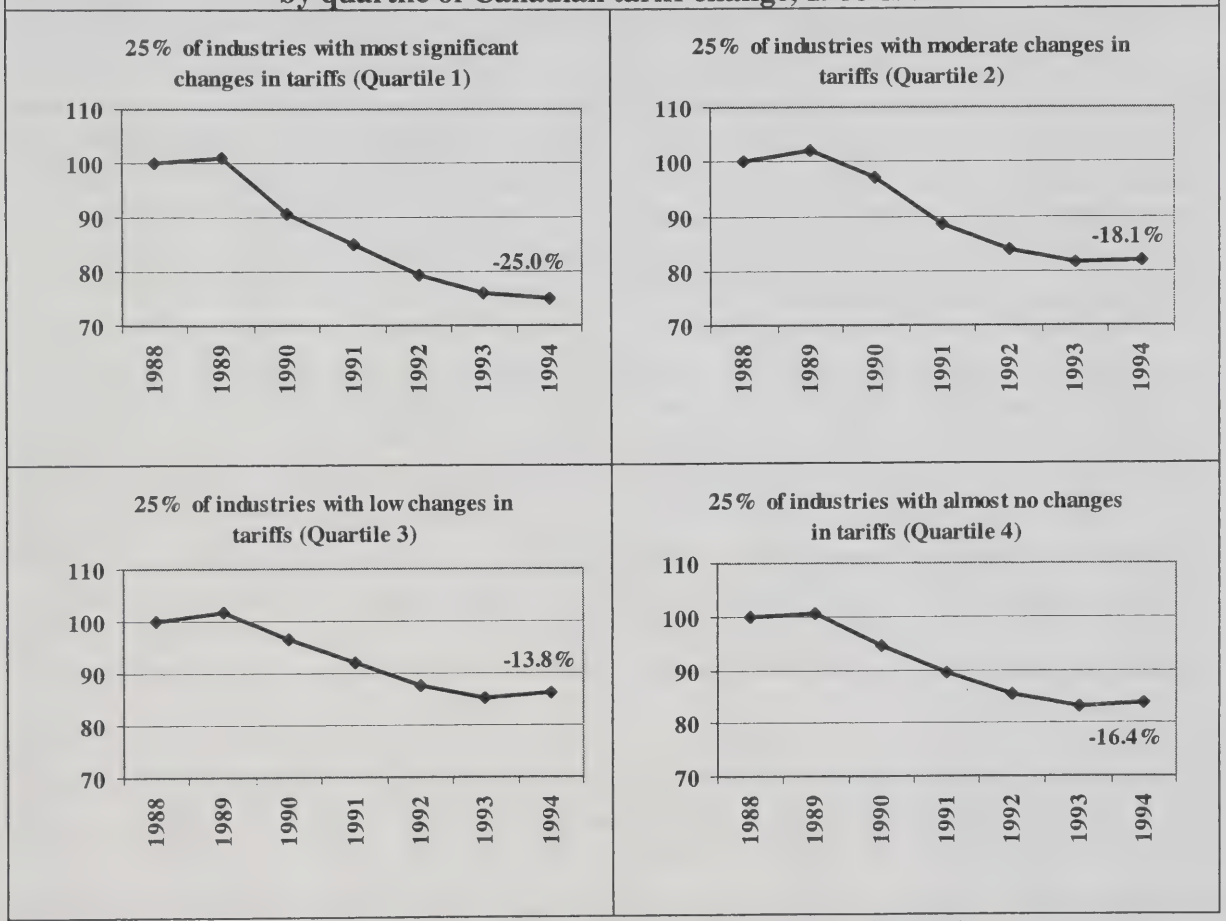
Figure 2.2: Index of manufacturing employees in Canada, 1988-1994



Source: Longitudinal Employment Analysis Program, T2/LEAP file.

More interestingly, manufacturing employment fell faster in industries experiencing the largest declines in domestic import tariffs (Figure 2.3). The top left panel shows the index of employment change in 25% of 83 manufacturing industries which experienced the most significant tariff declines. In this group, employment dropped by one-quarter. The top right panel indicates that employment changed by 18.1% in the quartile of industries with the second largest declines in tariffs. The two bottom panels of Figure 2.3 demonstrate that employment dropped by smaller margins in industries experiencing smaller tariff changes. These descriptive statistics are consistent with the idea that employment declined faster in industries with the largest changes in tariffs. This is significant because it raises the possibility that larger tariff cuts were associated with faster employment declines in the first few years of the Canada-U.S. FTA.

Figure 2.3: Index of manufacturing employees by quartile of Canadian tariff change, 1988-1994



Source: Longitudinal Employment Analysis Program, T2/LEAP file, surviving firms only.

3. Background

How should employment respond to changes in tariffs? One theory developed by Brander (1981) suggests a route by which changes in tariffs at the industry level might contribute to employment changes. This theory is built on the generally accepted principle that tariffs raise the cost of doing business abroad. The central assumption is that the consequences of foreign tariffs should be different from the consequences of domestic tariffs. This underscores the need to adopt a framework of analysis which separates the impact of falling domestic tariffs from the impact of falling foreign tariffs.

This theory predicts that the decline of domestic tariffs should increase sales of foreign firms on domestic markets. It also predicts that the decline of foreign tariffs should increase sales by local firms on foreign markets (all else equal). Because employment levels are closely related to sales, changes in domestic tariffs should be positively associated with employment changes in firms ($\partial e / \partial \tau > 0$) because falling domestic tariffs should remove jobs that were protected otherwise. Similarly, changes in foreign tariffs should be negatively associated with employment changes in firms ($\partial e / \partial \tau^* < 0$) because opportunities provided by falling foreign tariffs should contribute to create jobs. This raises the possibility that employment responded to falling tariffs at the beginning of the 1990s, but because tariffs were reduced on both sides of the border, the direction of change is uncertain.

3.1 Industry-level studies

Other studies have investigated the empirical link between the reduction in tariffs and employment changes by using industry-level data. These studies include Gaston and Trefler (1994) Gaston and Trefler (1997), Beaulieu (2000) and Trefler (2004). These studies all use a reduced-form equation derived from a general-equilibrium model of labour market equilibrium.[4] Gaston and Trefler (1997) and Trefler (2004) both find a significant association between employment changes and changes in Canadian tariffs across industries over the period 1988 to 1993, but demonstrate that job losses induced by the reduction of tariffs contributed to a relatively small fraction of total job losses experienced by the manufacturing sector at the beginning of the 1990s.[5]

Beaulieu (2000) uses a similar econometric framework to examine the extent to which tariff changes affected the earnings and employment of different categories of workers in manufacturing industries: production and non-production workers. Using employment data over a fourteen-year period (1983-96) for 19 manufacturing industries, Beaulieu finds that Canadian tariff reductions lowered employment among production workers but had little or no effect on non–production workers. This is significant because it raises the possibility that even within

4. Other empirical studies make use of general equilibrium or macro-econometric models to see the impact of a tariff reduction on the whole economy. Some of these studies were published prior to the introduction of free trade because the Canadian government sought to evaluate the costs and benefits of the implementation of a trade deal, and include the work made by Harris (1985) and the Economic Council of Canada (Magun et al., 1987, 1988).

5. Trefler (2004) also uses plant-level data from the Annual Survey of Manufacturers (ASM) to verify its results at the industry level. However, small firms are absent from the analysis and no distinction is made across categories of firms *a priori.*

industries, the employment effect of tariff reductions can be different across firms which employed proportionately more production workers than others.[6]

3.2 Firm-level studies

Other empirical studies focusing on firm survival have shown that tariff changes could have a different impact on more productive firms or firms in better financial health (Beaulieu, 2001; Gu, Sawchuk and Whewell, 2003; Baggs, 2004). This raises the possibility that the impact of tariff changes on employment is not only different across industries, but also across firms.

This paper uses firm-level data from the T2/LEAP (described below) to investigate the link between the reduction of Canadian and U.S. tariffs on employment fluctuations in Canadian manufacturing firms which existed before the implementation of the Canada-U.S. FTA and survived at least two complete years beyond this date. It also discusses the heterogeneity of the association between tariffs and employment across firms with different characteristics *a priori*.

Firm-level characteristics which could possibly affect how firms respond to tariff changes include productivity and leverage.

Melitz (2003) describes a model in which the existence of export market entry costs drastically affects how the impact of trade is distributed across different types of firms. Melitz argues that only the most efficient firms—that is, firms with lower per unit costs—should reap benefits from trade in the form of gains in market share and profits, and that less efficient firms lose both and become more likely to be forced out of business. This suggests that firms with higher productivity *a priori* should be better able to withstand negative shocks, such as the reduction of domestic tariffs, and should be better positioned to take advantage of employment opportunities created by falling foreign tariffs. Similarly, less productive firms should be affected more than the average firm by the impact of reduction in domestic tariffs. In recent years, several empirical studies have shown that less productive firms appear to be more responsive than other firms to changing domestic tariffs. These include the work of Baggs (2004) and Baldwin and Gu (2003), which conclude that the reduction of local tariffs led to a decrease in the probability of survival for low productivity firms. More particularly, Baggs (2004) finds that the Canadian tariffs reductions decreased the likelihood of survival, and U.S. tariff reductions had the opposite effect.

Another factor which may affect how a firm would typically respond to a change in tariffs is the financial condition of the firm, which this study proxies with leverage. The basic idea is that firms with "deeper pockets" should be better able to withstand the impact of "bad" states of the world (e.g., the reduction of domestic tariffs) and maximize the return of "good" states (e.g., the reduction in foreign tariffs). According to this theory, firms with unhealthy balance sheets *a priori* will bear the brunt of deteriorating credit market conditions following an unexpected shock in demand, because lenders flee from firms that face significant costs of borrowing, a

6. Beaulieu (2000), Trefler (2004) and Gaston and Trefler (1997) use IV (instrumental variables) estimation techniques to test whether the impact of tariff reduction on employment is different when tariffs are treated endogenously. All suggest that the coefficients associated with tariff reductions are biased downward when tariffs are treated exogenously, but no one could clearly reject the exogeneity of tariff cuts. Consequently, this paper does not report results obtained with IV estimation techniques. See Trefler (1993) for a detailed discussion about trade liberalization and the theory of endogenous protection.

phenomenon referred to as the "flight to quality" (Bernanke, Gertler, and Gilchrist, 1996). Reduction in credit available to these firms will exacerbate the problems related to reduced net worth at the firm, causing them to reduce output and employment more than others for a similar shock in product demand. This theory is well supported by some recent empirical findings. Zingales (1998), for instance, demonstrates that U.S. firms with less debt in the transportation industry have been the most able to adapt to an unexpected shock in product demand provoked by a change in transportation regulations. Likewise, Heisz and LaRochelle-Côté (2004) demonstrate that financially vulnerable firms in the Canadian manufacturing sector tend to shed more labour than healthier firms for an equal sized drop in product demand. Thus, firms with weaker balance sheets may have been more affected by changes in domestic tariffs, and firms which were less financially constrained may have benefited more from changes in U.S. tariffs.

The studies mentioned above have shown that the impact of trade liberalization may not be different only across industries, but also across firms. Hence, the effect of tariff reduction on employment may well differ across firms as well. This study investigates whether this is the case in section 5.

4. Data and method

4.1 Data

The data used in this paper come from Statistics Canada's T2/LEAP data set. This data link T2 corporate tax records of businesses to Statistics Canada's "Longitudinal Employment Analysis Program" (LEAP). Data are available for the period 1984 to 1998, but this paper focuses on the period 1988 to 1994 because most tariff cuts were implemented during that period and also because comparisons are made with results from other research focusing on the same time period. A firm enters LEAP when it registers for a payroll deduction account with Canada Revenue Agency (formerly Revenue Canada). It is linked with the Corporate Tax Statistical Universe (T2SUF), which tracks every incorporated firm in Canada filing a T2 form with Canada Revenue Agency. These two merged files form the T2/LEAP data used in this paper.[7] While the T2/LEAP contain information about businesses operating in all sectors of the economy, this paper focuses only on manufacturing firms. This is because tariff reductions mostly apply to tradable goods.

The focus is on manufacturing firms which existed prior to the implementation of the Canada-U.S. FTA. This paper does not examine whether the reduction of tariffs had an impact on firm survival. This issue has already been investigated in a recent paper (Baggs, 2004). This paper goes further by suggesting that some surviving firms also responded to tariff changes by cutting employment and by showing that the extent of this response varied across firms with different productivity and leverage characteristics.

The T2/LEAP has several advantages. First, it provides financial information together with employment numbers at the level of the firm. Second, the T2/LEAP can be seen as a longitudinal census of all incorporated manufacturing firms in the country, which opens the door to much detailed analysis (see Appendix A: Notes about the T2/LEAP).

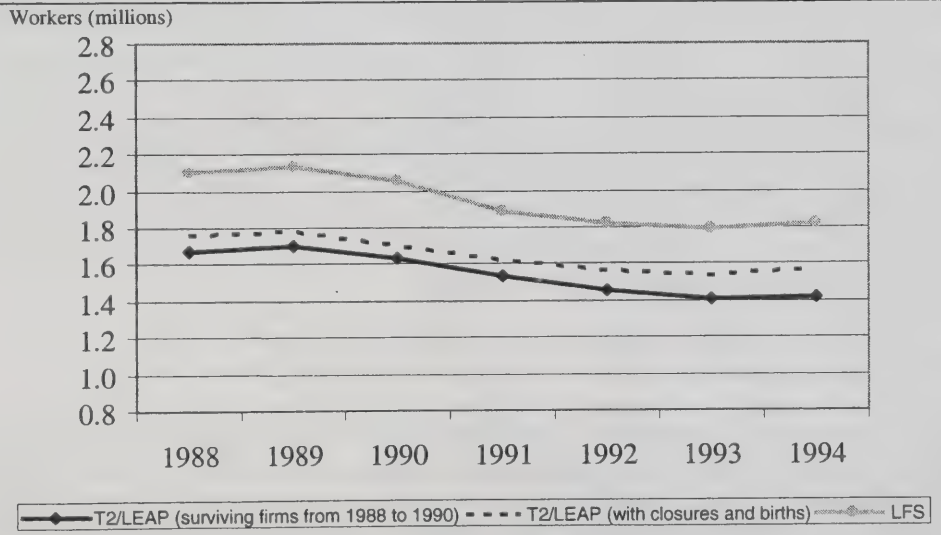
7. The T2/LEAP excludes own-account self-employed but not self-employed owners of incorporated businesses, who are employees of the corporation.

As indicated before, the sample includes figures from 1988 to 1994 for manufacturing firms that existed prior to 1988, and survived at least two complete calendar years (1988 and 1989). This period coincides with the implementation of the most significant tariff cuts negotiated under the free trade agreement. Firms that enter and exit in the same year (and firms that enter in one year and exit in the next) were excluded from the sample. Also, firms with a discontinuity in years reported and firms which did not report any value for assets or for sales were excluded. Firms for which the value reported for equity was higher than the value reported for assets were dropped from the sample. These exclusions, however, represent a relatively small proportion of the raw data.[8]

Firm-year observations corresponding to death years are not included. For example, if a firm went out of business in 1990, this firm will have only two observations in the sample, corresponding to its 1988 and 1989 figures. Of course, firm exit dictates that there are fewer observations in 1990 than in 1989; fewer observations in 1991 than in 1990, and so on. The result is a sample of 183,080 "firm-year" observations corresponding to 29,319 firms.

Figure 4.1 shows the number of workers in the sample from 1988 to 1994. Interestingly, this sample is very close to the number of workers which would have been obtained if the sample had included firms born after 1987 and firms which "died" before 1990. Figure 4.1 also reports annual estimates of manufacturing workers provided by the Labour Force Survey (LFS)—which includes incorporated and non-incorporated employees. Despite the large methodological differences between the two sources of data, employment trends were similar. Therefore, this sample of surviving firms reflects (at least at the aggregate level) trends in the manufacturing labour market between 1988 and 1994.

Figure 4.1: Number of manufacturing employees, 1988-1994, Canada

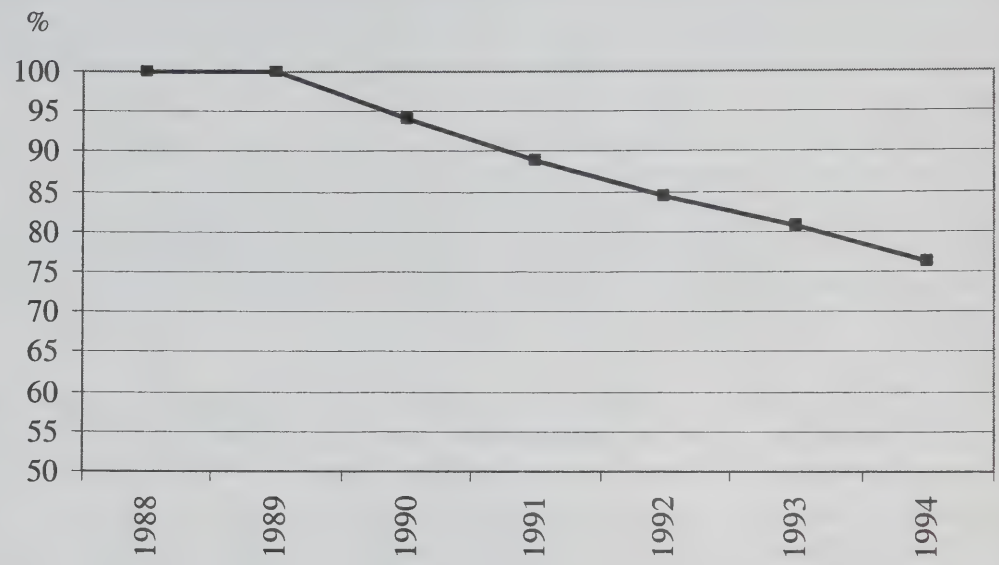


Source: Longitudinal Employment Analysis Program, T2/LEAP file and Labour Force Survey.

8. These exclusions represented approximately 7% of the raw data.

The close relationship between the number of workers in "surviving" and in the overall T2/LEAP may be due to the fact that most manufacturing firms downsized but did not necessarily shut down between 1988 and 1994. This is demonstrated by Figure 4.2, which shows that 76.3% of firms that were in this sample in 1988 and 1989 were still doing business in 1994.

Figure 4.2 : The survival rate of manufacturing firms in Canada, 1988-1994



Source: Longitudinal Employment Analysis Programs, T2/LEAP file.

One limitation of the sample selected is that it excludes firms which were born after the implementation of the Canada-U.S. free-trade deal. It is conceivable that more firms entered the market after the implementation of the Canada-U.S. FTA because of new opportunities created by declining U.S. tariffs. Nevertheless, the underestimation of the impact of declining U.S. tariffs is likely to be small for two reasons. First, empirical evidence from Gu, Sawchuk and Whewell (2003) has shown that tariff cuts implemented at the beginning of the 1990s had no effect on the decision of firms to enter the manufacturing industries. Second, total employment changes would have been only slightly different if births had been included in the sample (as indicated by Figure 4.1). Thus, the exclusion of births may slightly underestimate the beneficial impact of falling U.S. tariffs on manufacturing employment in Canada.

4.2 Method

This paper uses a fixed-effect model of employment which includes time-varying covariates at the firm level, the industry level, and the macroeconomic level that may affect firm employment. The fixed-effects model is advantageous because it allows one to account for fixed unobserved factors that may be correlated with firm employment. Following a method suggested in Baggs (2004), this model also includes Canadian and U.S. tariffs interacted with productivity and leverage *a priori*. Interaction terms are important because it allows the impact of tariffs to be differentiated across firms with different attributes in terms of productivity and leverage. The basic specification is the following:

$$L_{ijt} = \alpha_i + \beta_1 X_{it} + \beta_2 Y_{jt} + \beta_3 Z_t +$$
$$\theta_1(\tau_{jt} \times PROD_{i,1988}) + \theta_2(\tau^*_{jt} \times PROD_{i,1988}) + \qquad (1)$$
$$\theta_3(\tau_{jt} \times LEV_{i,1988}) + \theta_4(\tau^*_{jt} \times LEV_{i,1988}) + \varepsilon_{ijt}$$

The subscripts *i, j* and *t* refer to the firm, the industry and the year, respectively. The dependent variable (L_{ijt}) is the log of employment. The first independent variable (X_{it}) refers to time-varying factors that may affect employment changes at the level of the firm. Typically, such factors include sales. Sales are closely intertwined with employment in manufacturing firms and are readily available from the T2/LEAP. Thus, X_{it} includes the log of sales.

Y_{jt} refers to all industry-specific covariates, and includes Canadian and U.S. tariffs (which are denoted as τ_{jt} and τ^*_{jt} respectively). This paper uses Canadian and U.S. tariffs aggregated at the 3-digit SIC level. Tariff data is available for 83 different industrial groups over a seven-year period, which yields 581 different observations. In one alternative specification, industry-level variables also include estimates of U.S. employment by industry to account for the structural changes of the manufacturing sector. This phenomenon, often referred to as "deindustrialization",[9] is thought to have affected employment levels at the beginning of the 1990s as the Canadian economy became increasingly dominated by the services sector. All industry-level observations were matched to each firm by year and by industry.

The covariates Z_t refer to time-varying factors common to all industries and all firms. These include macroeconomic factors, such as the business cycle, inflation rates, interest rates and other economy-wide factors which may affect firm employment. One way to deal with these factors is to follow the approach suggested in Beaulieu (2000) and Baggs (2004), which is to use year dummy variables. In another alternative specification, the Canada-U.S. difference in interest rates and exchange rates are used instead of year dummies. The reason for doing this is that the policy of inflation control implemented in the same period may have contributed to the deterioration of labour market conditions by worsening the recession (Fortin, 1996). Furthermore, the strong Canadian dollar was also often cited as a possible contributing factor to declining profits and employment in Canadian manufacturing industries. Hence, interest rates and exchange rates are used to account for the policy of low inflation rate targeted by the Bank of Canada at the beginning of the 1990s, which led to higher interest rates relative to U.S. rates and an appreciated Canada-U.S. exchange rate.[10]

9. "Deindustrialization" refers to the underlying transformation of the economy into a services economy at the expense of "industrial" sectors. Following Gaston and Trefler (1997), I use U.S. employment figures by industry at the 2-digit level from the U.S. Bureau of Labor Statistics to account for underlying determinants of structural change in one alternative specification. Results are shown in section 5.2.

10. The measure of interest rate employed in this paper is the spread between Canadian and U.S. three-month Treasury bill. U.S. rates are from CANSIM table number 176-0042 and Canadian rates are from CANSIM table number 176-0043. Exchange rates are expressed in $US per Canadian dollar and are from CANSIM table number 176-0064.

Finally, the model includes Canadian and U.S. tariffs interactions with firm productivity and leverage at the onset of the Canada-U.S. FTA (in 1988), which yields a total of four interaction variables. This is important because it allows the impact of Canadian and U.S. tariffs to be differentiated across firms with different productivity and leverage characteristics *a priori*.[11]

Leverage values were obtained by using variables that were readily available in the T2/LEAP. The leverage value employed is the 1988 ratio of liabilities over assets, which could be easily obtained by using values of equity and assets reported by firms in the T2/LEAP.[12]

Productivity values could not be computed as easily because the data does not report any specific value about the intensity of the factors of production. However, it was possible to develop estimates of Total Factor Productivity (TFP) based on the Cobb-Douglas production function by using the 1988 values reported for the number of employees and the value of assets. Owing to concerns that TFP estimates might be less accurate than labour productivity estimates[13], one alternative specification shows the results when labour productivity is used instead of TFP estimates (see Appendix B: Developing Productivity Estimates). Results obtained for alternative specifications are discussed in section 5.2. Detailed results are shown in Appendix C.

5. Results

5.1 Base model

Section 3 has shown that the coefficients associated with Canadian tariffs should be positive if falling domestic tariffs removed jobs that were protected otherwise. Conversely, the coefficients associated with U.S. tariffs are expected to be negative, because opportunities provided by falling foreign tariffs may have contributed to create jobs.

Table 5.1 displays the complete results for the base model. The first column of Table 5.1 shows the results obtained when interaction variables are excluded from the analysis. Although both coefficients associated with tariffs are consistent with our expectations, none are significant. This suggests that the overall impact of tariff declines on employment was relatively small.

11. One possible limitation of a model with interaction variables is that the effect of tariffs on employment may not be linearly distributed across firms with various productivity levels. This is discussed in Appendix D, which shows the results of an alternative method with dummy variables. The results obtained with this alternative model were consistent with those obtained with the base model.

12. The financial values of the T2/LEAP were rendered temporally comparable by deflating financial variables (assets, equity and sales) with the Industrial Price Index of Statistics Canada.

13. Baldwin, Jarmin and Tang (2002) use data from the Annual Survey of Manufactures (ASM) to show that output per worker (using value-added) in small firms was about 55% the level of output per worker in larger firms in 1987. Using the same definition of small and large firm used in Baldwin, Jarmin and Tang, the estimate of output per worker (using sales) in small firms was about 63% that of large firms in 1988. No such comparison could be made to compare TFP levels.

Table 5.1: Fixed-effects regression of employment, 1988-1994

	(1)	(2)	(3)
Sales	0.428*	0.438*	0.439*
	(0.011)	(0.011)	(0.011)
Canadian tariffs	0.009	0.167*	0.163*
	(0.008)	(0.025)	(0.024)
U.S. tariffs	-0.006	-0.105*	-0.097*
	(0.015)	(0.042)	(0.042)
Productivity & Canadian tariffs		-0.056*	-0.057*
		(0.008)	(0.008)
Productivity & U.S. tariffs		0.033*	0.034*
		(0.014)	(0.014)
Leverage & Canadian tariffs			0.009*
			(0.004)
Leverage & U.S. tariffs			-0.016~
			(0.008)
Year dummies	Yes	Yes	Yes
N	183,080	183,080	183,080
R-squared	24.7%	26.1%	26.1%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries. Similar results were found for the period 1988 to 1997 (see Appendix C).

*=significant at 5%.

~=significant at 10%.

Source: Data from the T2/LEAP file.

However, the coefficient associated with Canadian tariffs becomes larger and significant when interaction variables are included in the analysis. This suggests that the reduction of Canadian tariffs was positively associated with a reduction of employment in Canadian manufacturing, and that firms were not all equally affected by declining domestic tariffs.

Likewise, the coefficients associated with U.S. tariffs become significant when the model includes interaction variables. This suggests that U.S. tariff declines have been associated with employment gains, and that the benefits associated with this reduction were not equally shared by all firms.

Now consider the productivity interactions. The coefficients of productivity interacted with Canadian tariffs are negative and significant. One interpretation of this is that declining domestic tariffs were associated with job losses in firms which were less productive *a priori*. This is consistent with other research (Baggs, 2004; Baldwin and Gu, 2003) showing that the decline of Canadian tariffs accelerated the exit of least productive firms. It also suggests that higher productivity sheltered firms from the effect of changing tariffs.

Theory suggests that more jobs should be created as a result of falling U.S. tariffs in firms which were more productive *a priori*. However, the U.S. tariffs interaction with productivity is positive and significant. This suggests that the fall in tariffs has been relatively more beneficial for firms which were relatively *less* productive—not more. One possible explanation for this is that more productive firms were less likely to expand their activities because they were perhaps already exporting to the U.S. markets prior to the implementation of the tariff reduction scheme. In other words, it is possible that opportunities provided by falling U.S. tariffs were comparatively more valuable for firms with lower productivity levels. This hypothesis is also supported by the work of Baggs (2004), who finds that falling U.S. tariffs increased the odds of survival but more so in least productive firms. This raises the possibility that improved opportunities provided by declining U.S. tariffs allowed less efficient firms to continue operating.

The heterogeneous impact of tariff reductions across firms with various productivity levels can be best understood with one simple example. Firms with average productivity in 1988 responded to tariff changes by cutting employment by only 3.6% over the period 1988 to 1994. By contrast, low productivity firms[14] responded to tariff changes by cutting 15.1% of their workforce over the same period. However, the impact of declining domestic tariffs in low-productivity firms was partly offset by falling U.S. tariffs. Were it not for the gains associated with declining U.S. tariffs, low-productivity firms would have lost 21.6% of their workforce. Hence, the gains associated with U.S. tariffs did not compensate for the loss of jobs induced by falling domestic tariffs in low productivity firms. On the basis of such results, it is clear that the impact of tariff reduction varied substantially across firms with various productivity levels.

The interaction term of leverage with Canadian tariffs is positive and significant. This supports the view that firms with more debt shed relatively more labour and suggests that financial constraints became more binding when tariff reductions were implemented. It also suggests that firms with "deeper pockets" were better able to adjust to increased competition from foreign firms. This view is consistent with Zingales (1998) and Heisz and LaRochelle-Côté (2004), who demonstrate that highly-leveraged firms shed typically more labour in response to a shock in product demand.

The final interaction term of leverage with U.S. tariffs was negative and significant at the 10% level. This suggests that the impact of falling U.S. tariffs may have been beneficial for more leveraged firms. Such results are counterintuitive but are consistent with Baggs (2004), who demonstrates that firms with more leverage benefited proportionately more from the impact of changing U.S. tariffs. By way of explanation, Baggs raises the possibility that high debt firms pursue strategies that raise returns in "good states of the world" and "lower returns in bad states". According to this theory, firms with more debt typically adopt financial strategies designed to

14. Low-productivity firms are defined as those that were located one standard deviation under the average productivity level in 1988.

maximize the returns to shareholders in case of a positive industrial change (such as declining U.S. tariffs). Likewise, such firms also pursue financial strategies designed to minimize returns to shareholders in the event of a negative shock (such as declining domestic tariffs).[15] This is because the interests of bondholders normally take precedence over the interests of shareholders when more leveraged firms are facing insolvency, while shareholders gain most from a positive change in business conditions. Consequently, risk taking firms should benefit more from the opportunities created by U.S. tariffs, but should also experience greater damage when domestic protection falls. This hypothesis is supported by the empirical findings of this paper and supports the view that low leverage made firms less sensitive to the impact of falling domestic and U.S. tariffs.

This section has shown that the overall effect of tariff changes on employment was relatively small, but the impact of tariff reduction varied quite substantially across various classes of firms. Firms which were less productive *a priori* reduced employment more in the wake of declining domestic tariffs, but benefited proportionately more from declining U.S. ones. Firms with more leverage also shed more labour in response to declining Canadian tariffs, but may have gained more from falling U.S. tariffs. These results suggest that firms with more productivity and with fewer debts were sheltered from the impact of falling domestic and U.S. tariffs.

5.2 Alternative specifications

This section discusses the results of alternative specifications. Table 5.2 shows the results obtained for the coefficients associated with tariffs and the coefficients associated with interaction variables. Readers who are interested in detailed results for these alternative specifications are invited to examine Appendix C.

Five other specifications were used. The second column of Table 5.2 shows the results when labour productivity estimates are used instead of TFP estimates. The third column shows the results when estimates of U.S. employment by industry are incorporated in the model to account for the underlying transformation of the economy into a services economy at the expense of the manufacturing sector. The fourth column shows the results when interest and exchange rates are used instead of year dummies. The fifth column indicates the results obtained when the reference period is extended to 1997—the last year before the few remaining tariffs were formally removed. The last column shows the results when very small firms (those with less than 2 workers in 1988) are removed from the analysis.

Interestingly, the results are quite consistent from one specification to the other. First, the coefficient associated with Canadian and U.S. tariffs remain consistent with our expectations. One possible exception is the labour productivity model, where the coefficient associated with Canadian tariffs is almost double the size of the same coefficient in other specifications. Thus, the labour productivity model reinforces the view that the impact of declining Canadian tariffs has been larger than the impact of declining U.S. tariffs.

15. This can be referred to as the "limited liability of debt financing". See Jensen and Meckling (1976) and Brander and Lewis (1986) for a detailed discussion of this theory.

The Canadian tariffs interactions with productivity remain also very consistent, supporting the view that low productivity firms lost more jobs in the face of declining domestic tariffs and gained relatively more from U.S. tariffs, but not enough to compensate for losses induced by domestic tariffs.

Of the five alternative models presented in Table 5.2, three indicate that the coefficient associated with the interaction of Canadian tariffs with leverage is positive and significant (the two others coefficients were not statistically different from zero). This appears to support the idea that the impact of declining domestic tariffs was larger in firms with more leverage. Finally, the coefficient associated with the final interaction of U.S. tariffs with leverage was negative and significant at the 10% level in most specifications, suggesting that the impact of declining U.S. tariffs may have been more beneficial to firms with more leverage. This supports the view that firms with fewer debts were sheltered from the impact of falling domestic and U.S. tariffs.

Table 5.2: Fixed-effects regression of employment with interaction variables: Alternative specifications

	Original model	Labour productivity instead of TFP	With U.S. employment	Interest and exchange rates	1988 to 1997	Excluding very small firms (ALU<2)
Sales	0.439*	0.441*	0.437*	0.439*	0.502*	0.421*
Canadian tariffs	0.163*	0.261*	0.161*	0.175*	0.127*	0.136*
U.S. tariffs	-0.097*	-0.109	-0.095*	-0.091*	-0.071*	-0.070~
Productivity and Canadian tariffs	-0.056*	-0.057*	-0.056*	-0.056*	-0.046*	-0.049*
Productivity and U.S. tariffs	0.034*	0.024	0.030*	0.031*	0.029*	0.027*
Leverage and Canadian tariffs	0.009*	-0.001	0.008*	0.008*	0.008	0.018*
Leverage and U.S. tariffs	-0.016~	-0.006	-0.013~	-0.015~	-0.018~	-0.026~
Year dummies	Yes	Yes	Yes	No	Yes	Yes
N	183,080	183,080	183,080	183,080	239,013	164,351
R-squared	26.1%	27.8%	26.4%	25.8%	32.0%	27.8%

Note: Detailed results of alternative specifications are shown in Appendix C.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

6. Conclusion

In the late 1980s, the implementation of a Canada-U.S. negotiated deal of reductions in tariffs changed the business environment of Canadian manufacturing firms. Empirical studies using industry-level data have shown that the shock in product demand induced by falling domestic tariffs significantly affected employment in industries that recorded the most severe tariff cuts. Studies have also shown that falling U.S. tariffs had the opposite effect.

Recent empirical studies on firm survival have also suggested that the impact of changing domestic and foreign tariffs could vary not only across industries, but also across firms. These studies include the work of Beaulieu (2001), Gu, Sawchuk and Whewell (2003); Baggs, Head and Ries (2002) and Baggs (2004) and suggest that the response to changing tariffs could vary across firms with different attributes. This paper discusses the heterogeneity of the association between tariffs and employment across various categories of firms. It finds that the impact of tariff changes varied across various categories of productivity and leverage.

The results suggest that the impact of falling Canadian tariffs on employment was larger in firms which were less productive *a priori*. This is consistent with other research (Baggs, 2004; Baldwin and Gu, 2003) saying that the decline of Canadian tariffs accelerated the exit of least productive firms. However, falling U.S. tariffs partially offset the negative effect of falling domestic tariffs for those low productivity firms. This may be because more productive firms were already exporting to the United States, while low productivity firms were less likely to do so.

This paper also indicates that firms with more leverage—e.g., firms with higher debt to assets ratios—downsized more in the face of changing domestic tariffs. This supports the view that firms with "deeper pockets" were better able to adjust to increased competition from foreign firms and is also consistent with evidence suggesting that firms with larger financial constraints respond more to a sudden decline in product demand (Zingales, 1998; Heisz and LaRochelle-Côté, 2004).

These results suggest that firms with high productivity and low leverage were less likely than others to feel the impact of declining U.S. and domestic tariffs.

By way of caution, it should be noted that this paper focuses on the direct impact of falling tariffs only and does not focus on the possible dynamic gains of free trade. Free trade theory suggests that liberalization should contribute to lower prices and give consumer demand a boost. This paper discusses labour market adjustments which took place in the immediate period following the implementation of the Canada-U.S. free trade. It does not discuss employment gains that may have been realized in the long run because of rising consumer demand, and does not discuss the employment situation of the services sector. More research is needed to understand the long-term impact of trade liberalization.

Appendix A:

Notes about the T2/LEAP

The T2/LEAP includes annual values of assets, equity, sales, inventory and employment for all incorporated firms in Canada. In this database, the concept of "average labour units" (ALU) is used to approximate the number of employees in the firm. These units of labour are computed by taking the total payroll of the enterprise for the year, divided by the average annual income of workers in the corresponding province, size class, and industry (3 digits SIC level). Previous studies have shown that annual changes in the number of ALUs are similar to annual changes in paid workers in official figures provided by the Labour Force Survey.[16] Therefore, average labour units can reasonably be seen as reliable estimates of the size of the workforce at the firm level.

LEAP employment figures are measured by calendar year, while T2 data is reported on a fiscal year basis. Data are rendered temporally comparable by adjusting T2 data according to the following algorithm:

$$C_t = \phi F_{t-1} + \gamma F_t \qquad \text{(A-1)}$$

where C_t is the amount of the variable in calendar year t, F is the fiscal year amount, and ϕ is the portion of days in the fiscal year t-1 in calendar year C_t, and γ is the portion of days in the fiscal year t in calendar year C_t. Entry into LEAP corresponds to the first year during which the firm hires employees and can be referred to as the enterprise "birth". Following the approach suggested in Baggs (2004), a firm is said to "exist" when it has positive counts of average labour units.

16. More details on LFS-LEAP comparisons of labour measurement can be found in "Developing a Longitudinal Database on Businesses in the Canadian Economy: An Approach to the Study of Employment", Statistics Canada (1988), Catalogue no. 18-501E.

Appendix B:

Developing productivity estimates

The T2/LEAP does not contain any specific value about the intensity of the factors of production used by the firms. One possibility is to estimate productivity by using a well-established approach originally suggested in Griliches and Mairesse (1990) and more recently in Hall and Jones (1999) and Baggs (2004). The method is used to generate estimates of Total Factor Productivity from a simple Cobb-Douglas production function. The Cobb-Douglas function stipulates that the production of the firm (Y_i) will depend on the intensity of capital (K_i) and labour (L_i) used, multiplied by a certain productivity level (A_i):

$$Y_i = A_i K_i^{\alpha} L_i^{1-\alpha} \qquad \text{(B-1)}$$

Solving for productivity and taking the natural log of both sides, equation (B-1) yields the following result:

$$\ln(A_i) = \ln(\frac{Y_i}{L_i}) - \alpha \ln(\frac{K_i}{L_i}) \qquad \text{(B-2)}$$

The first term on the right-hand side can be interpreted as an estimate of labour productivity and the second term represents the amount of capital each firm has at its disposal. Using the T2/LEAP, it is possible to use ALUs as a reliable measure for L_i. Sales can also be used as a good proxy for Y_i. Because there is no measure of capital per worker in the T2/LEAP, Baggs (2004) suggests using the value of assets as a proxy. Thus, the following specification can be used to estimate productivity at the firm's level:

$$\ln(A_i) = \ln(\frac{Sales_i}{ALU_i}) - \alpha_j \ln(\frac{Assets_i}{ALU_i}) \qquad \text{(B-3)}$$

The variable α_j can be interpreted as the contribution of capital to the total value added of industry j. The measurement of this industry-specific variable is relatively straightforward and can be obtained by using aggregated data by SIC-80 industry at the 3-digit level from the Annual Survey of Manufactures (CANSIM table no.301-0001):

$$\alpha_j = 1 - W_j / VA_j \qquad \text{(B-4)}$$

W_j represents the salaries and wages paid to all workers in industry j and VA represents the manufacturing value added of that industry.

Another possibility is to classify firms by using a simpler measure of value added per worker (or labour productivity). This can be done by dividing sales (which can be used as a proxy for output) over the number of labour units (ALU) reported for each firm in 1988. Results are shown in Table C-1 of Appendix C.

Appendix C:

Results of Alternative Specifications

Table C-1: Fixed-effects regression of employment, 1988-1994: With labour productivity instead of total factor productivity

	(1)	(2)	(3)
Sales	0.428* (0.011)	0.442* (0.011)	0.441* (0.011)
Canadian tariffs	0.009 (0.008)	0.261* (0.043)	0.261* (0.043)
U.S. tariffs	-0.006 (0.015)	-0.113 (0.087)	-0.109 (0.087)
Productivity and Canadian tariffs		-0.057* (0.009)	-0.057* (0.009)
Productivity and U.S. tariffs		0.024 (0.018)	0.024 (0.018)
Leverage and Canadian tariffs			-0.001 (0.004)
Leverage and U.S. tariffs			-0.006 (0.009)
Year dummies	Yes	Yes	Yes
N	183,080	183,080	183,080
R-squared	24.7%	27.8%	27.8%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

Table C-2: Fixed-effects regression of employment, 1988-1994: With U.S. employment

	(1)	(2)	(3)
Sales	0.426* (0.011)	0.437* (0.011)	0.437* (0.011)
Canadian tariffs	0.008 (0.008)	0.165* (0.024)	0.161* (0.024)
U.S. tariffs	-0.012 (0.016)	-0.102* (0.041)	-0.095* (0.041)
Productivity and Canadian tariffs		-0.055* (0.008)	-0.056* (0.008)
Productivity and U.S. tariffs		0.029* (0.014)	0.030* (0.014)
Leverage and Canadian tariffs			0.008* (0.004)
Leverage and U.S. tariffs			-0.013~ (0.008)
U.S. employment	0.776* (0.213)	0.890* (0.228)	0.889* (0.228)
Year dummies	Yes	Yes	Yes
N	183,080	183,080	183,080
R-squared	24.9%	26.4%	26.4%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

Table C-3: Fixed-effects regression of employment, 1988-1994: With interest and exchange rates instead of year dummies

	(1)	(2)	(3)
Sales	0.429* (0.011)	0.439* (0.011)	0.439* (0.011)
Canadian tariffs	0.024* (0.008)	0.179* (0.026)	0.175* (0.026)
U.S. tariffs	-0.006 (0.017)	-0.098* (0.042)	-0.091* (0.043)
Productivity and Canadian tariffs		-0.055* (0.008)	-0.056* (0.008)
Productivity and U.S. tariffs		0.031* (0.013)	0.031* (0.013)
Leverage and Canadian tariffs			0.008* (0.004)
Leverage and U.S. tariffs			-0.015~ (0.008)
Interest rates	0.012* (0.004)	0.012* (0.004)	0.012* (0.004)
Exchange rates	0.109 (0.183)	0.119 (0.187)	0.120 (0.187)
Year dummies	No	No	No
N	183,080	183,080	183,080
R-squared	24.3%	25.8%	25.8%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

Table C-4: Fixed-effects regression of employment, 1988-1997: (instead of 1988 to 1994)

	(1)	(2)	(3)
Sales	0.494* (0.012)	0.502* (0.012)	0.502* (0.012)
Canadian tariffs	0.002 (0.006)	0.131* (0.018)	0.127* (0.018)
U.S. tariffs	0.002 (0.011)	-0.081* (0.034)	-0.071* (0.033)
Productivity and Canadian tariffs		-0.046* (0.006)	-0.046* (0.006)
Productivity and U.S. tariffs		0.028* (0.012)	0.029* (0.012)
Leverage and Canadian tariffs			0.008 (0.005)
Leverage and U.S. tariffs			-0.018~ (0.009)
Year dummies	Yes	Yes	Yes
N	239,013	239,013	239,013
R-squared	30.8%	32.0%	32.0%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

Table C-5: Fixed-effects regression of employment, 1988-1994: Excluding very small firms (ALU<2)

	(1)	(2)	(3)
Sales	0.410*	0.420*	0.421*
	(0.012)	(0.012)	(0.012)
Canadian tariffs	0.008	0.144*	0.136*
	(0.008)	(0.022)	(0.023)
U.S. tariffs	-0.005	-0.082*	-0.070~
	(0.014)	(0.038)	(0.039)
Productivity and Canadian tariffs		-0.048*	-0.049*
		(0.008)	(0.008)
Productivity and U.S. tariffs		0.026~	0.027*
		(0.013)	(0.013)
Leverage and Canadian tariffs			0.018*
			(0.007)
Leverage and U.S. tariffs			-0.026~
			(0.013)
Year dummies	Yes	Yes	Yes
N	164,351	164,351	164,351
R-squared	26.5%	27.7%	27.7%

Note: Standard errors are in parentheses. Standard errors have been adjusted to correct for the possible clustering of firms across industries.
*=significant at 5%.
~=significant at 10%.
Source: Data from the T2/LEAP file.

Appendix D:

Robustness check

One possible limitation of the model described in Section 4.2 is that the impact of tariffs on employment may not be linearly distributed across firms with various productivity levels. This is important because the main finding of this study is that the impact of tariffs varied across firms with various productivity levels. One way to deal with this is to develop a model where the productivity interaction is multiplied with dummy variables corresponding to productivity deciles. Detailed results are shown in Table D-1:

Table D-1: Fixed-effects regression of employment, 1988-1994: With productivity interactions distributed along productivity deciles

	Coefficient	S.E.	t	P>|t|
Sales	0.434	0.011	37.90	0.000
Canadian tariffs	0.069	0.014	4.74	0.000
U.S. tariffs	-0.041	0.021	-1.95	0.055
Productivity interaction with Can. tariffs (decile 2)	-0.018	0.005	-3.59	0.001
Productivity interaction with Can. tariffs (decile 3)	-0.021	0.005	-4.12	0.000
Productivity interaction with Can. tariffs (decile 4)	-0.020	0.006	-3.42	0.001
Productivity interaction with Can. tariffs (decile 5)	-0.021	0.005	-4.01	0.000
Productivity interaction with Can. tariffs (decile 6)	-0.024	0.006	-4.09	0.000
Productivity interaction with Can. tariffs (decile 7)	-0.020	0.005	-3.75	0.000
Productivity interaction with Can. tariffs (decile 8)	-0.022	0.005	-4.22	0.000
Productivity interaction with Can. tariffs (decile 9)	-0.028	0.005	-5.71	0.000
Productivity interaction with Can. tariffs (decile 10)	-0.037	0.006	-6.54	0.000
Productivity interaction with U.S. tariffs (decile 2)	0.008	0.008	0.93	0.356
Productivity interaction with U.S. tariffs (decile 3)	0.015	0.008	1.88	0.064
Productivity interaction with U.S. tariffs (decile 4)	0.014	0.010	1.40	0.166
Productivity interaction with U.S. tariffs (decile 5)	0.015	0.008	1.92	0.059
Productivity interaction with U.S. tariffs (decile 6)	0.018	0.009	1.90	0.061
Productivity interaction with U.S. tariffs (decile 7)	0.010	0.009	1.12	0.264
Productivity interaction with U.S. tariffs (decile 8)	0.014	0.009	1.58	0.117
Productivity interaction with U.S. tariffs (decile 9)	0.018	0.008	2.22	0.029
Productivity interaction with U.S. tariffs (decile 10)	0.025	0.010	2.44	0.017
Leverage interaction with Can. tariffs	0.009	0.004	2.37	0.020
Leverage interaction with U.S. tariffs	-0.017	0.008	-2.15	0.034
Year dummy: 1989	0.020	0.009	2.18	0.032
Year dummy: 1990	0.010	0.016	0.64	0.525
Year dummy: 1991	-0.046	0.020	-2.27	0.026
Year dummy: 1992	-0.072	0.024	-3.03	0.003
Year dummy: 1993	-0.074	0.029	-2.58	0.012
Year dummy: 1994	-0.104	0.033	-3.19	0.002

# of observations: 183,080

R-squared: 26.2%

Note: Standard errors have been adjusted to correct for the possible clustering of firms across industries.

Source: Data from the T2/LEAP file.

The first decile includes firms that were in the bottom productivity decile in 1988. Likewise, the 10th decile includes firms that were in the top productivity decile in 1988. In this model, the coefficient associated with Canadian and U.S. tariffs shows the effect of changing tariffs on employment in firms that are in the bottom productivity decile. The productivity interactions indicate the extent to which the effect of changing tariffs for firms in other deciles is different from the effect for firms in the bottom productivity decile. Hence, the effect of changing tariffs on other productivity deciles can be obtained by adding the coefficient associated with tariffs with the corresponding productivity interaction.[17]

The positive and significant coefficient associated with Canadian tariffs shows that firms in the bottom productivity decile shed employment in the face of declining domestic tariffs. However, the productivity interaction coefficients show that this effect was not as large for firms in more productive deciles. For instance, the coefficient associated with changing domestic tariffs for firms in the second productivity decile was also significant (0.051=0.069-0.018), but lower than the coefficient obtained for firms in the bottom productivity decile (0.069). The coefficient associated with domestic tariffs in firms that were in the top productivity decile in 1988 was much lower 0.032 (0.069-0.037)—suggesting that employment changes associated with declining domestic tariffs were much smaller in most productive firms. Clearly, such results tend to support the view firms which were less productive *a priori* downsized more when domestic tariffs fell. It also supports the view that higher productivity sheltered firms from the effect of changing tariffs.

The coefficient associated with U.S. tariffs was -0.040 for firms in the bottom productivity decile and was significant (at the 10% level). However, this effect was much smaller for firms in the top productivity deciles. For instance, the coefficient associated with U.S. tariffs for firms in the top productivity decile was smaller (-0.016=-0.040+0.025) and no longer significant—suggesting that falling U.S. tariffs partially offset the negative effect of falling domestic tariffs in firms which were less productive *a priori* but not in more productive ones, as evidenced in section 5 of this paper.

17. Quintiles were also used to check the robustness of the findings and did not significantly alter the results.

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